



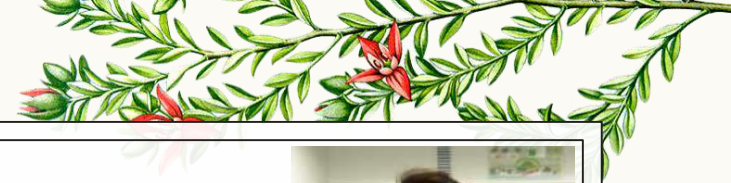
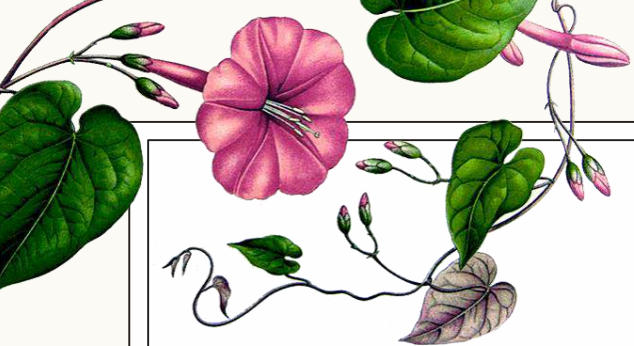
UPM
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

Climate Change and its Impact on Agricultural Productivity



in Malaysia





Presented By

ASSOCIATE PROFESSOR
DR. ABDUL RAHIM ABDUL SAMAD



Global Warming

FOR

- Climates changed before
- It's the sun
- It's still cooling
- Animals and plants can adapt



AGAINST

- Climate reacts to whatever forces it to change at the time
- The sun has been going in the opposite directions
- The last decade has been the hottest on record
- There can be mass extinction of species that cannot adapt



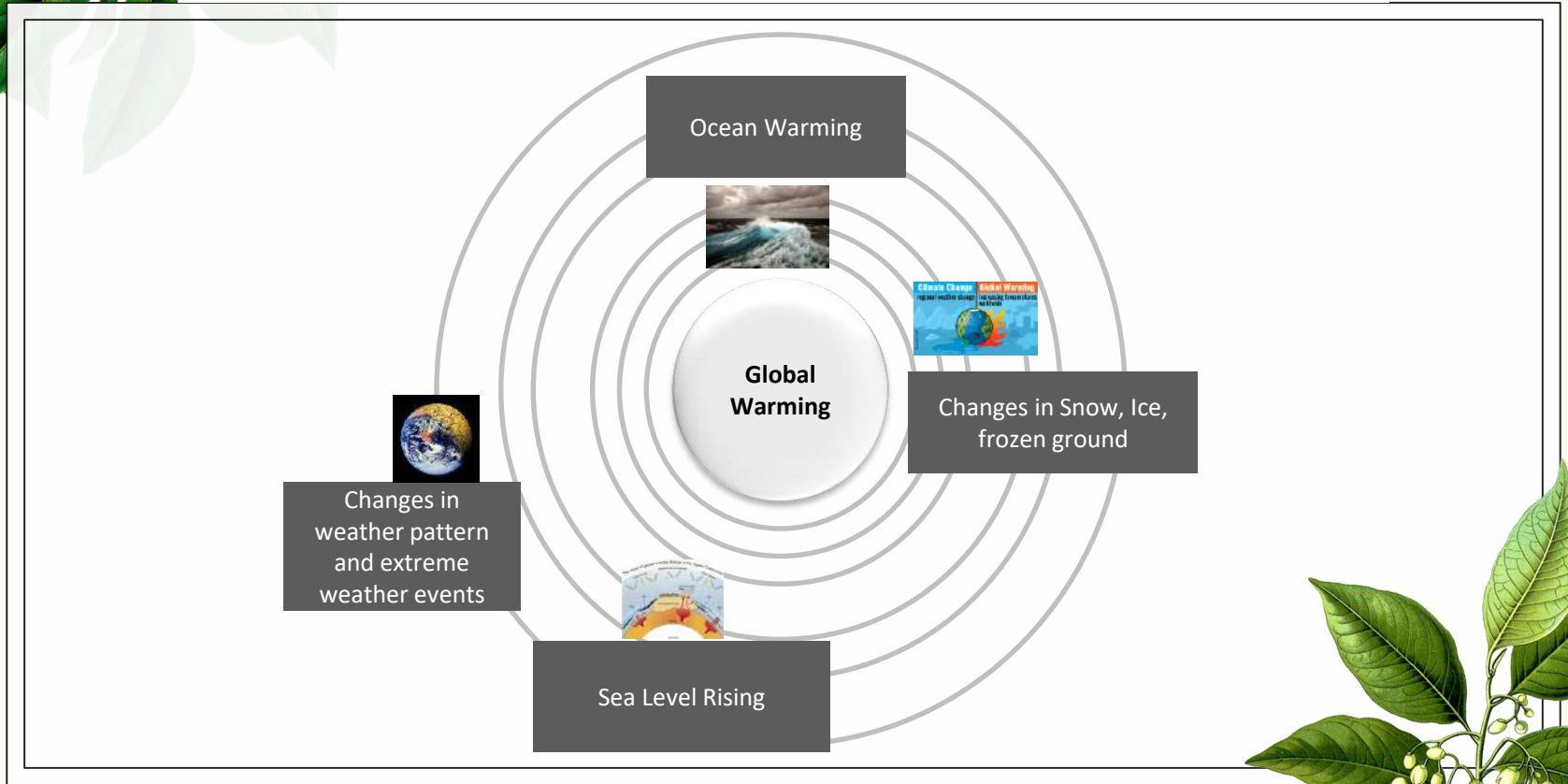


*“There’s one issue that will define
the contours of this century more
dramatically than any other, and
that is the urgent threat of a
Climate Change”*

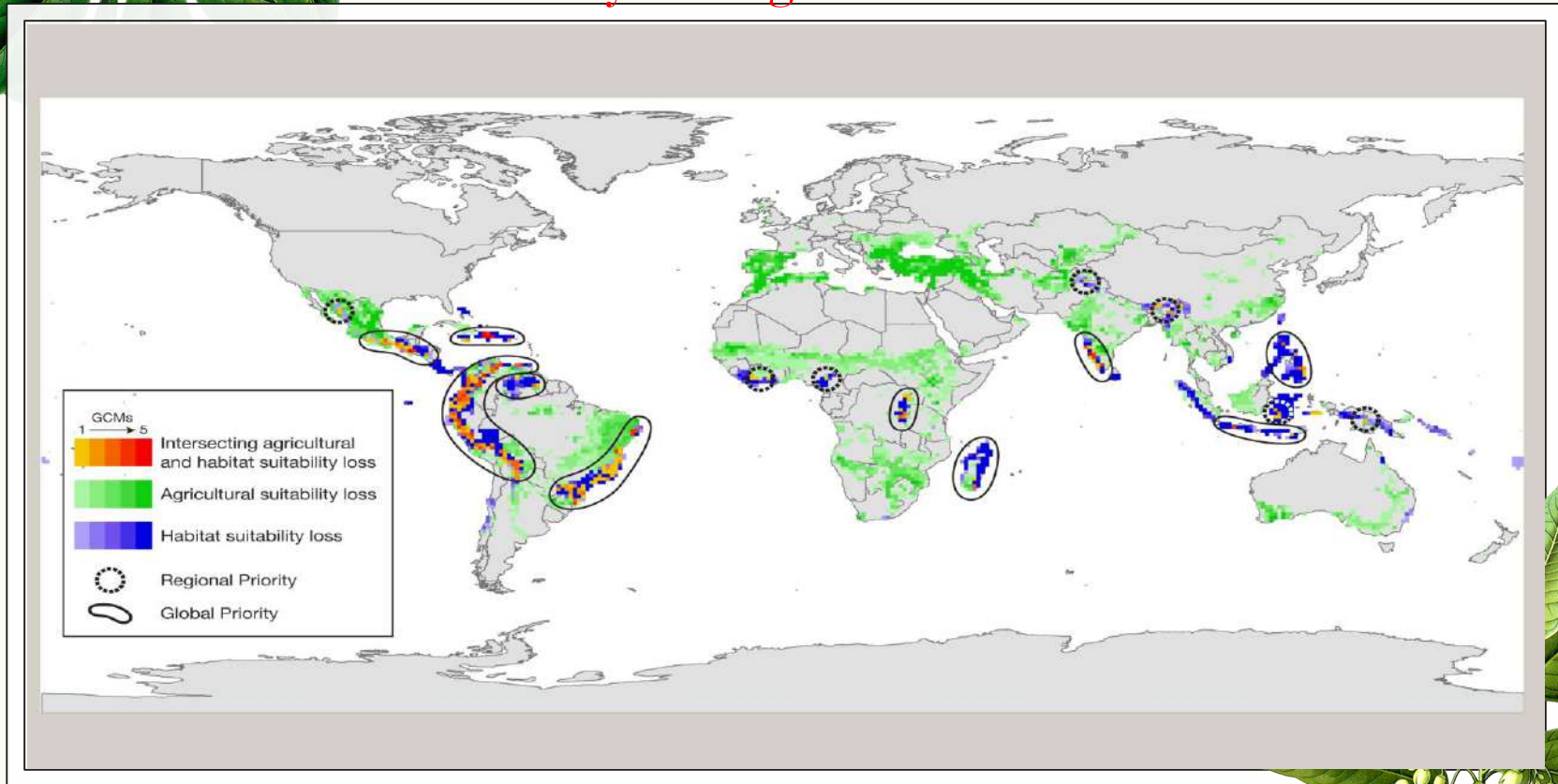
Barrack Obama

”

Climate Change Scenario



Top ten regions for climate change impacts on biodiversity and Agriculture



Source: Hannah, Lee, Makihiko Ikegami, David G. Hole, Changwan Seo, Stuart HM Butchart, A. Townsend Peterson, and Patrick R. Roehrdanz. "Global climate change adaptation priorities for biodiversity and food security." PLoS One 8, no. 8 (2013): e72590.

Climate Change and Biodiversity

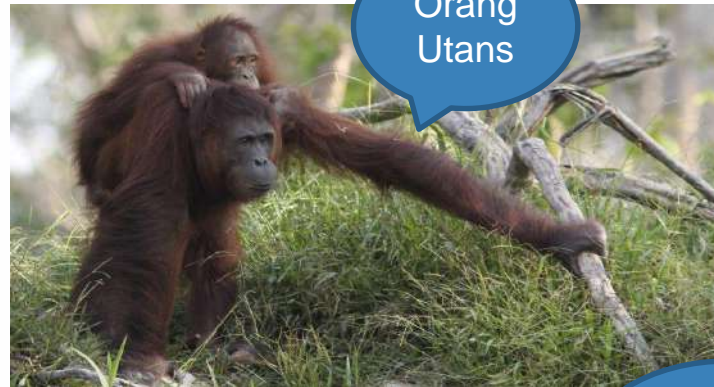


Polar Bears



Corals

WE ARE THREATENED



Orang Utans



Arctic Reindeers

Climate Change and Marine Ecosystem



THREATS TO CORAL REEFS

CLIMATE CHANGE

Increased greenhouse gases from human activities result in climate change and ocean acidification.

CLIMATE CHANGE = OCEAN CHANGE

CO₂

The world's ocean is a massive sink that absorbs carbon dioxide (CO₂). Although this has slowed global warming, it is also changing ocean chemistry.

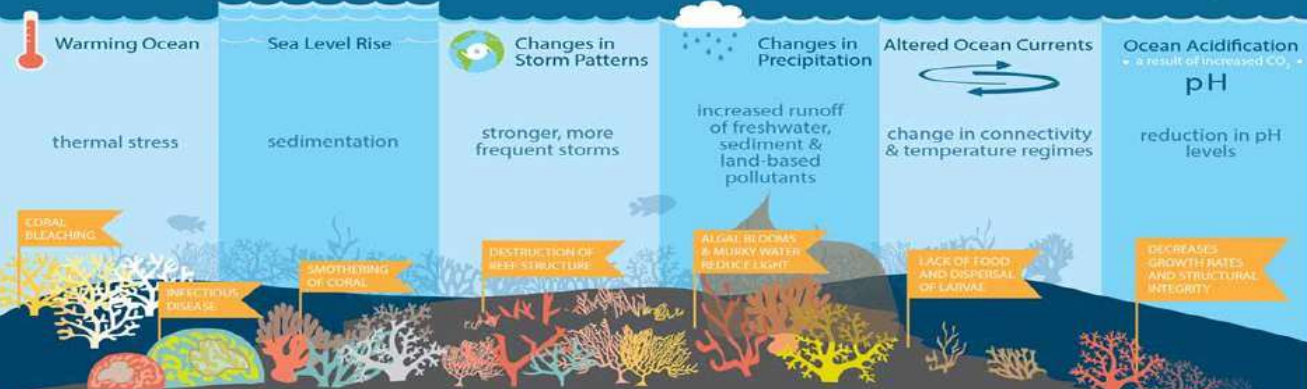
HOW YOU CAN HELP

Shrink your carbon footprint to reduce greenhouse gases.

- Drive less.
- Reduce, reuse or recycle.
- Purchase energy-efficient appliances and lightbulbs.
- Print less. Download more. Use less water.



CLIMATE CHANGE dramatically affects CORAL REEF ECOSYSTEMS



Impacts are immediate and long term, direct and indirect - A weakened coral is vulnerable.

Do your part to help improve overall coral reef condition.

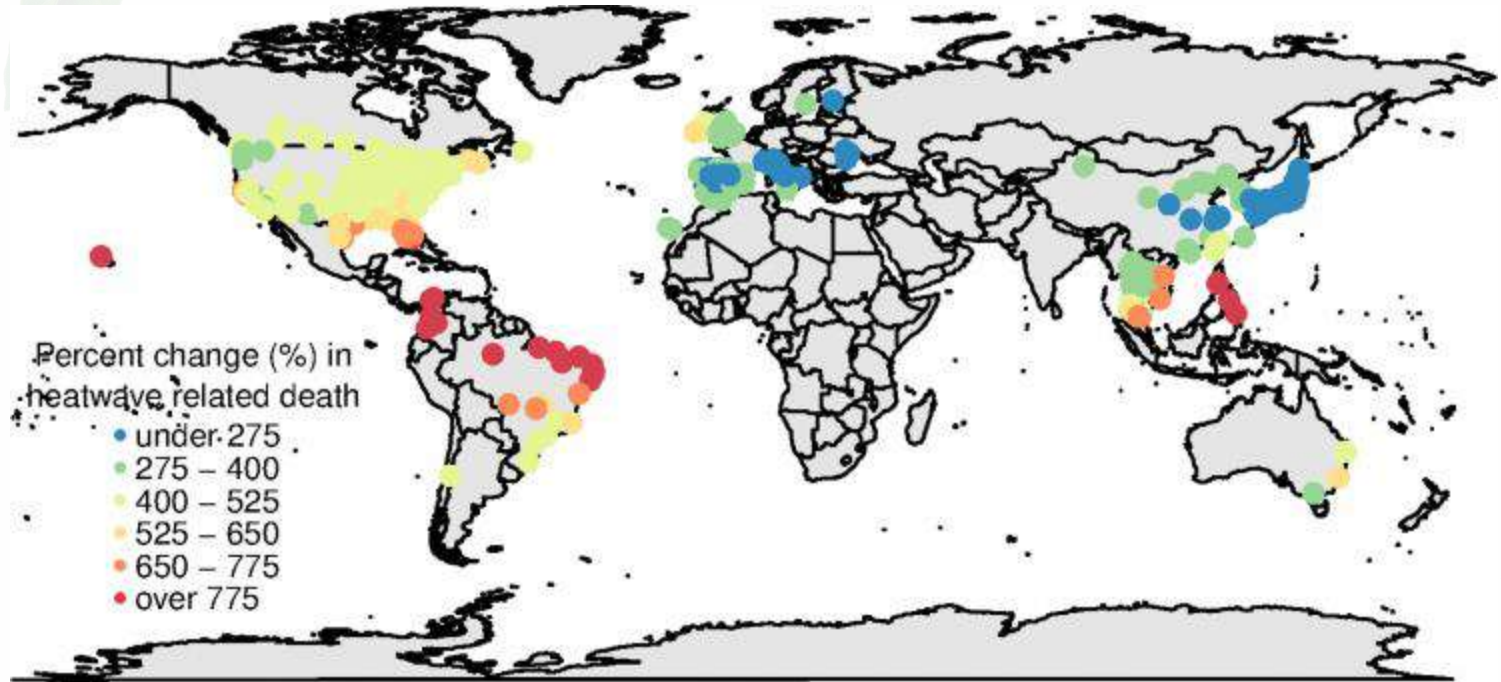
- Reduce the use of lawn and garden chemicals.
- DO NOT dump household chemicals in storm drains.
- Choose sustainable seafood. www.FishWatch.com
- Learn about good reef etiquette and practice it when in the water.
- Volunteer for beach and waterway clean ups.

Climate Change and Human Health



Source: NEWS.COM.AU

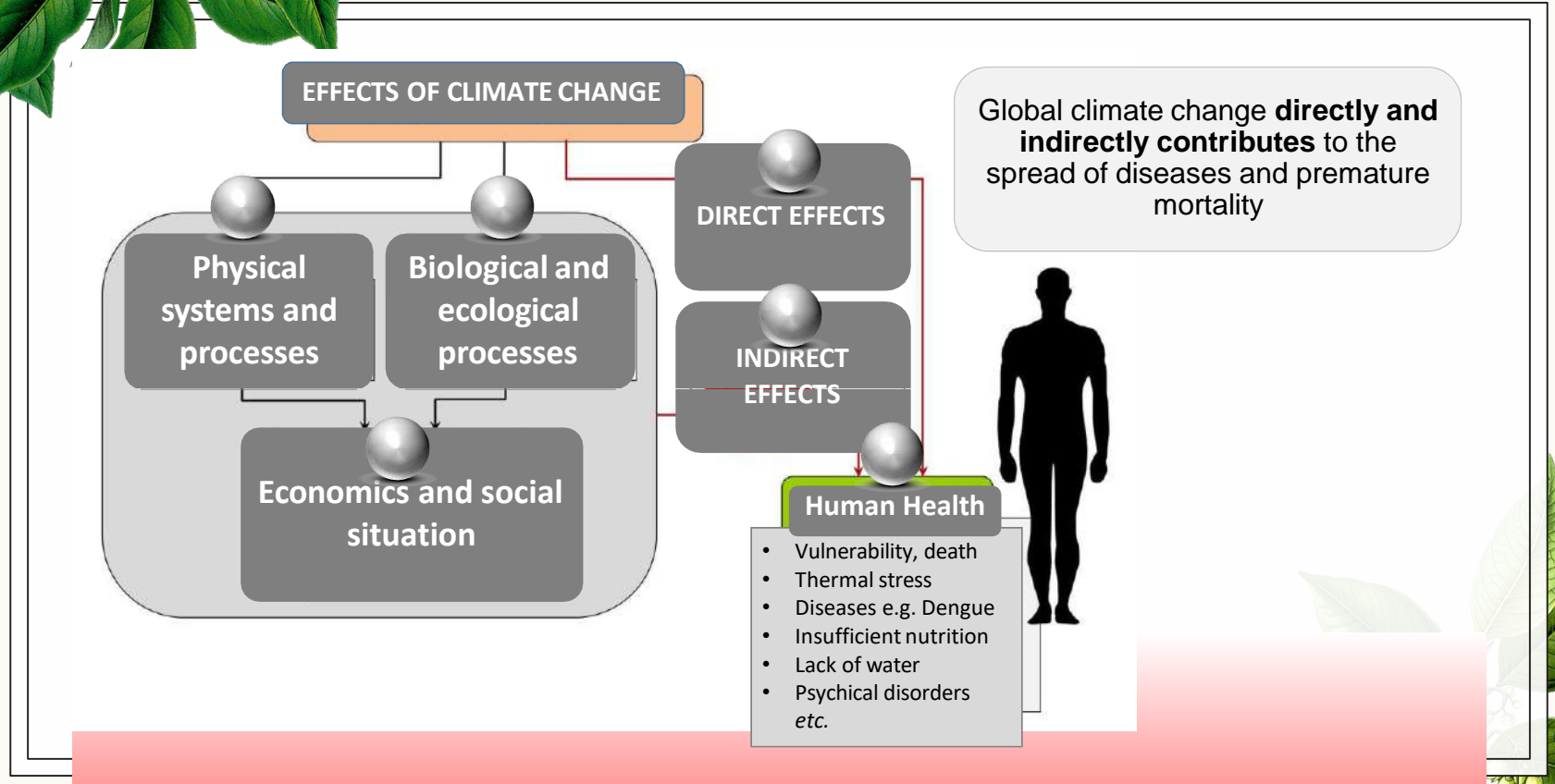
Climate change and heatwave-related mortality



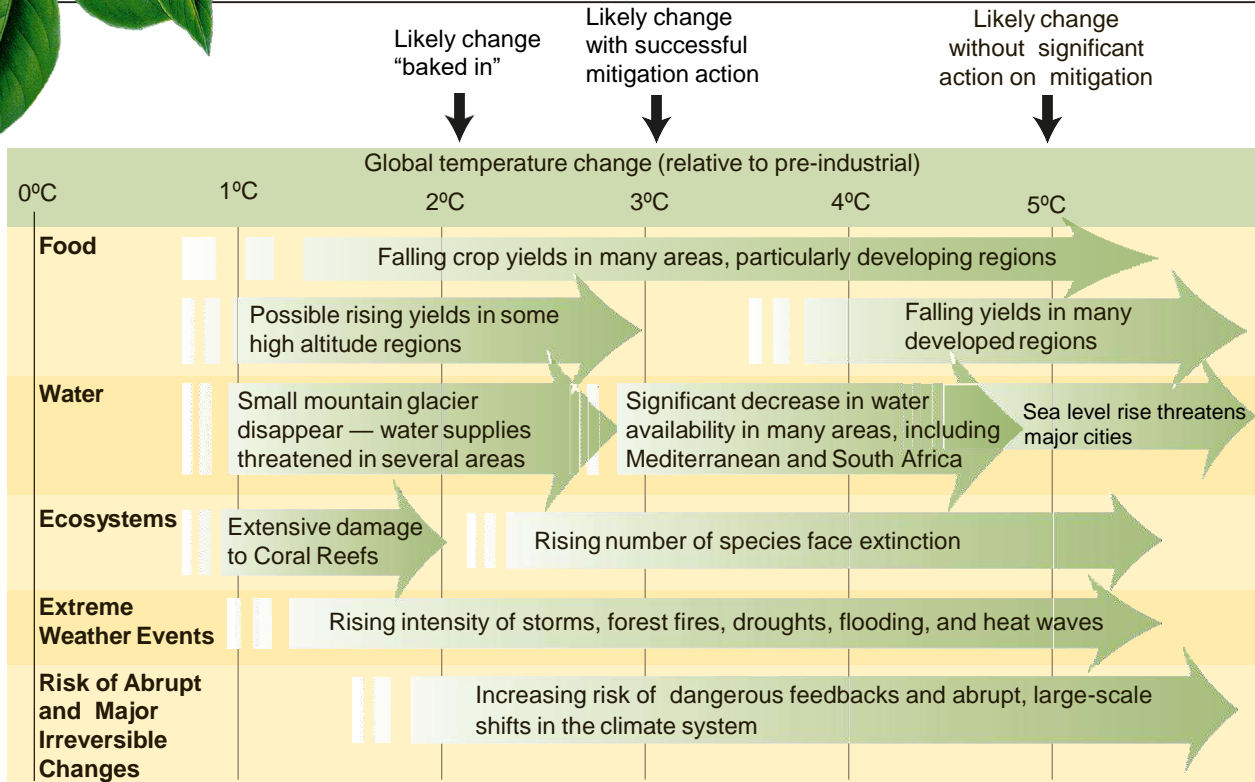
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Source: Guo, Y., Gasparrini, A., Li, S., Sera, F., Vicedo-Cabrera, A. M., Coelho, M. D. S. Z. S., ... & Overcenco, A. (2018). Quantifying excess deaths related to heatwaves under climate change scenarios: A multicountry time series modelling study. *PLoS medicine*, 15(7), e1002629.

Summary of Climate Change impacts on Human Health

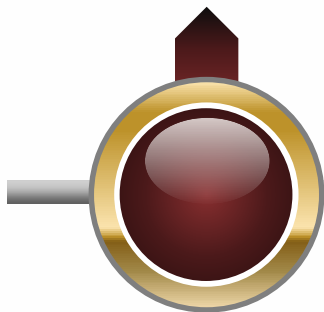


Biodiversity and Climate Change Adaptation



Interesting Facts

Fact 1



The global climate system continues to warm

Fact 2



Human-induced greenhouse gas emissions

Fact 3



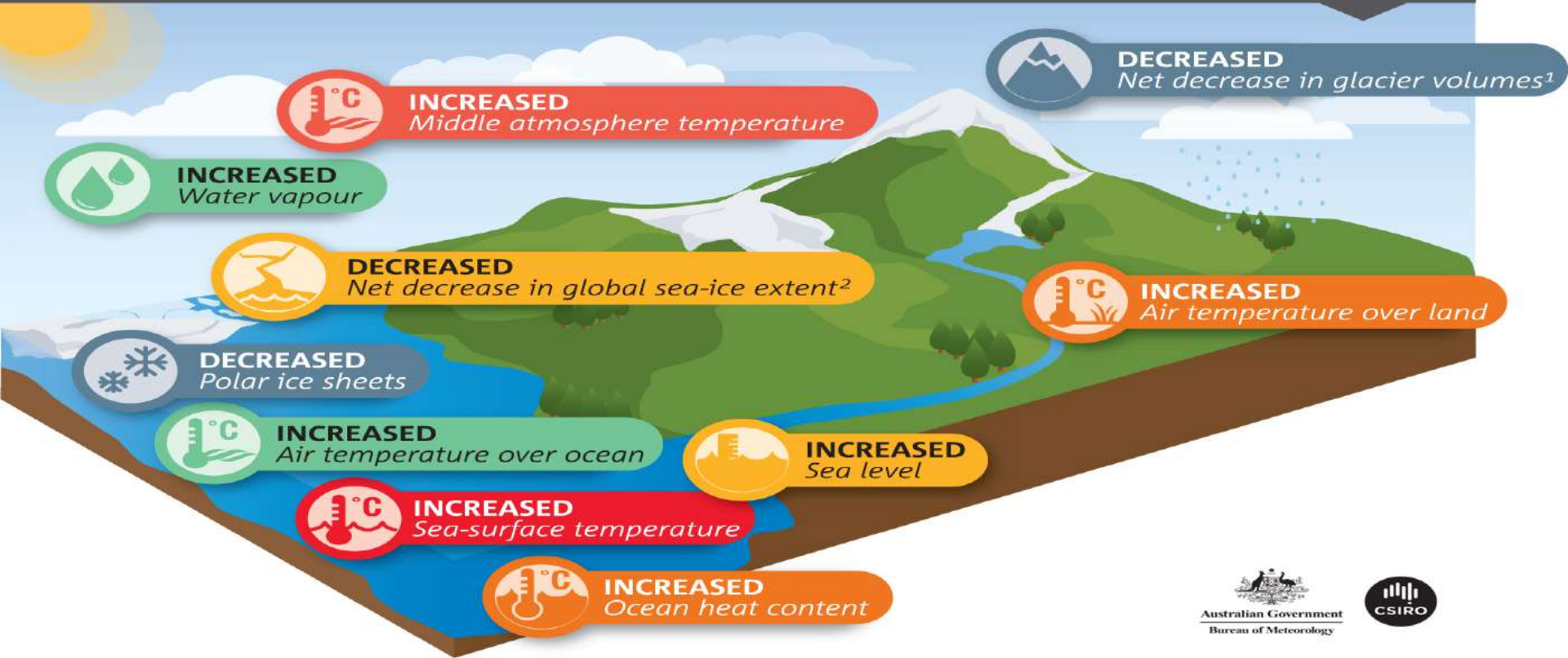
Global mean sea level increased throughout the 20th century and in 2012 was 225 mm higher than in 1880

Fact 4



Global surface temperatures in 2017 was the second warmest since 1880, according to NASA

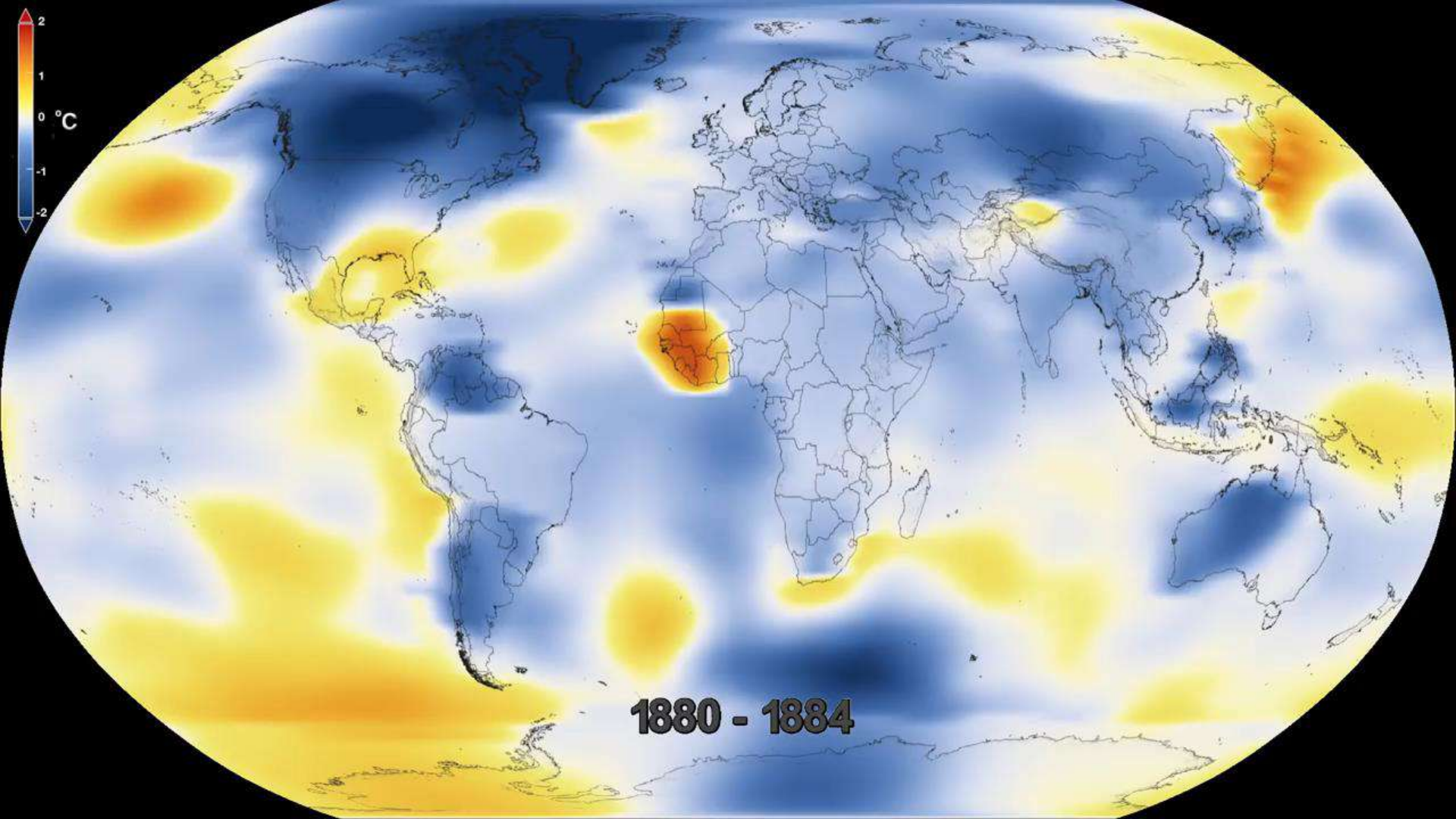
Changes in the global climate system



Indicators of a world experiencing a consistent pattern of warming.

¹ With regional variation (almost all glaciers worldwide losing mass but some gaining) but overall net loss.

² With regional variation (large loss in the Arctic, small net gain in the Antarctic) but overall net loss.



1880 - 1884



Climate Change and Agriculture

1

Global Status

2

Malaysia Status

3

Impact on Malaysia Agricultural Productivity

4

Which Way?



Climate Change and Agriculture

IMPACTS OF CLIMATE CHANGE

By **2030**, nine out of 10 of the major crops will experience reduced or stagnant growth rates, while average prices will increase dramatically as a result, at least in part, due to climate change.



MAIZE

12%

GROWTH RATE
DECREASE

90%

PRICE
INCREASE



RICE

23%

GROWTH RATE
DECREASE

89%

PRICE
INCREASE



WHEAT

13%

GROWTH RATE
DECREASE

75%

PRICE
INCREASE



OTHER CROPS

8%

GROWTH RATE
DECREASE

83%

PRICE
INCREASE

Source: HARVARD BUSINESS SCHOOL

Agriculture and Climate: A bi-directional relationship

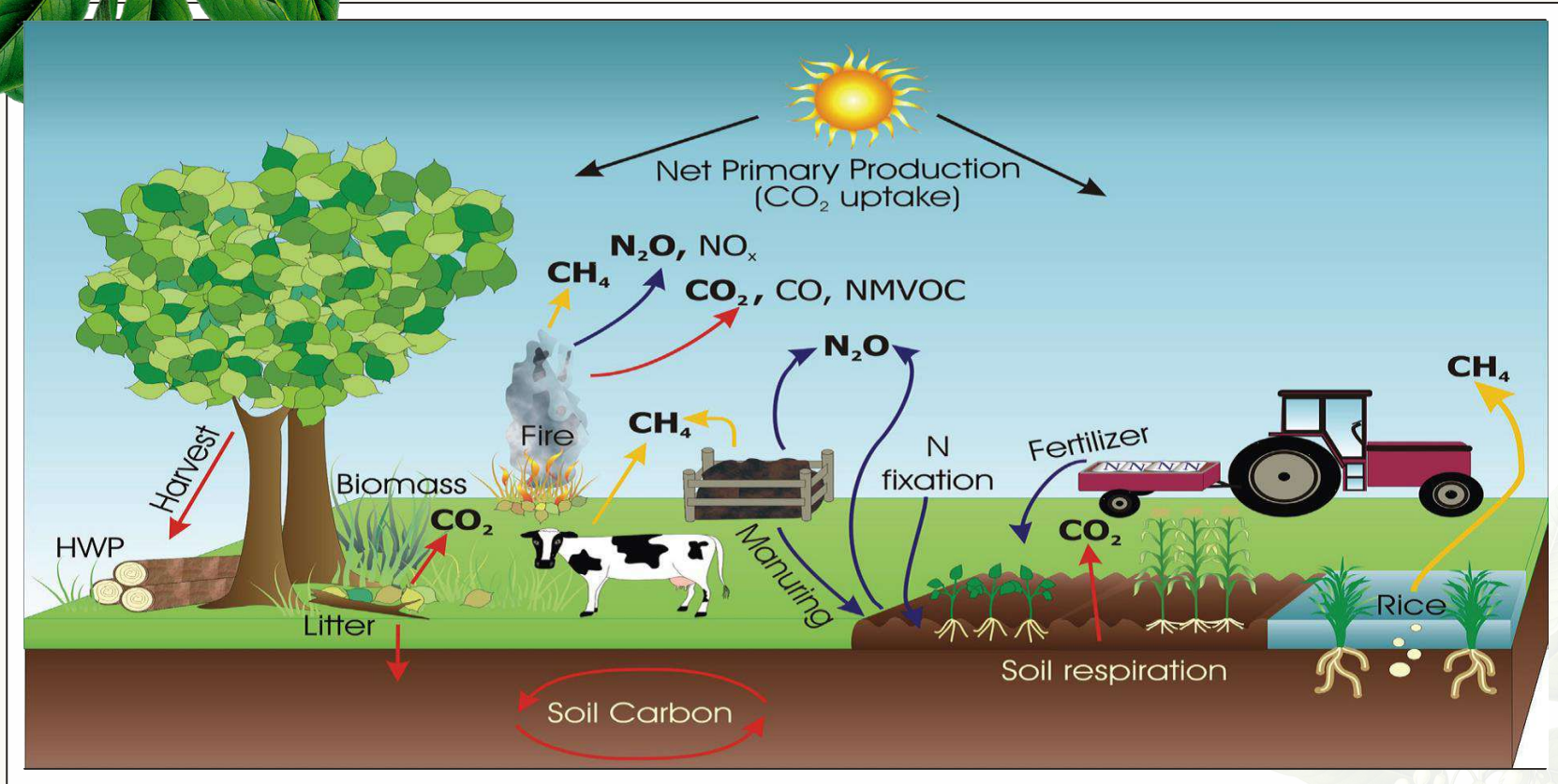
Gas emissions, chemical use,
soil and crop management,
and transportation contribute
to climate change



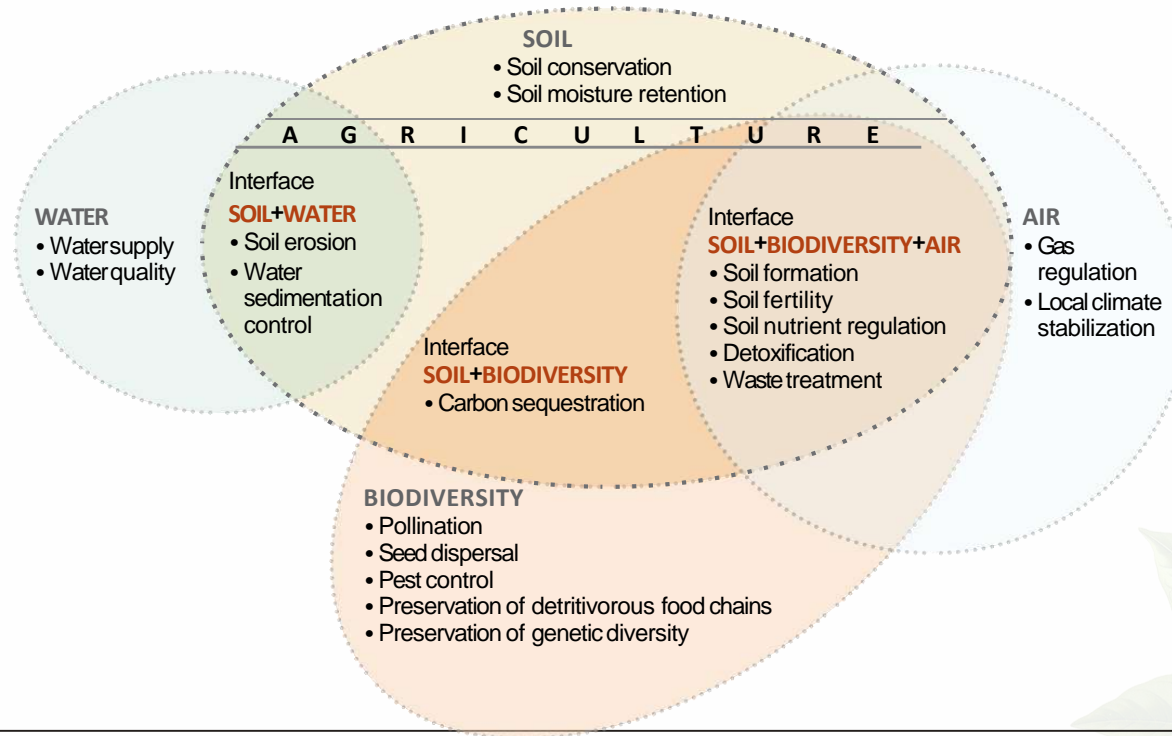
Climate changes impacts on
temperature, rainfall, and
pollution negatively impact
agriculture production

Source: HARVARD BUSINESS SCHOOL

Greenhouse gas emission in managed ecosystems.



Some ecosystem services rendered by agriculture





The Big concept



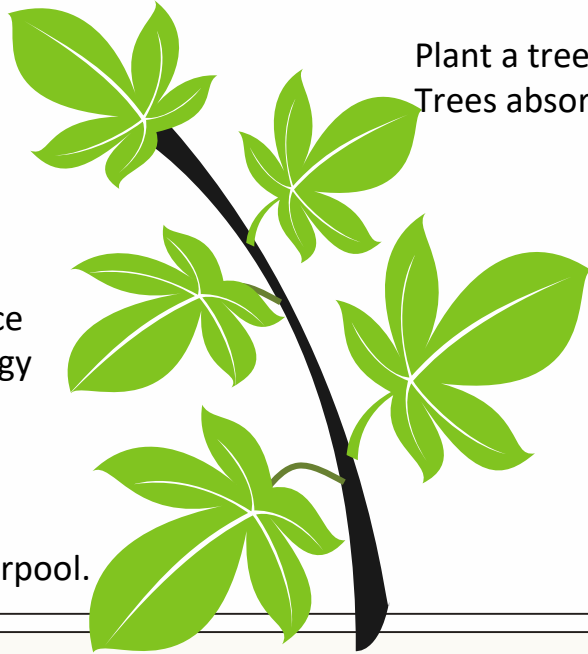
We all can play a part



Zero Emissions

Recycle and reuse products, since making new stuff requires more energy

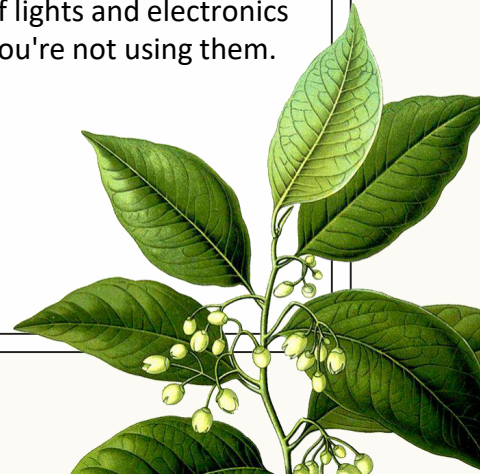
Take the bus, ride a bike, or carpool.



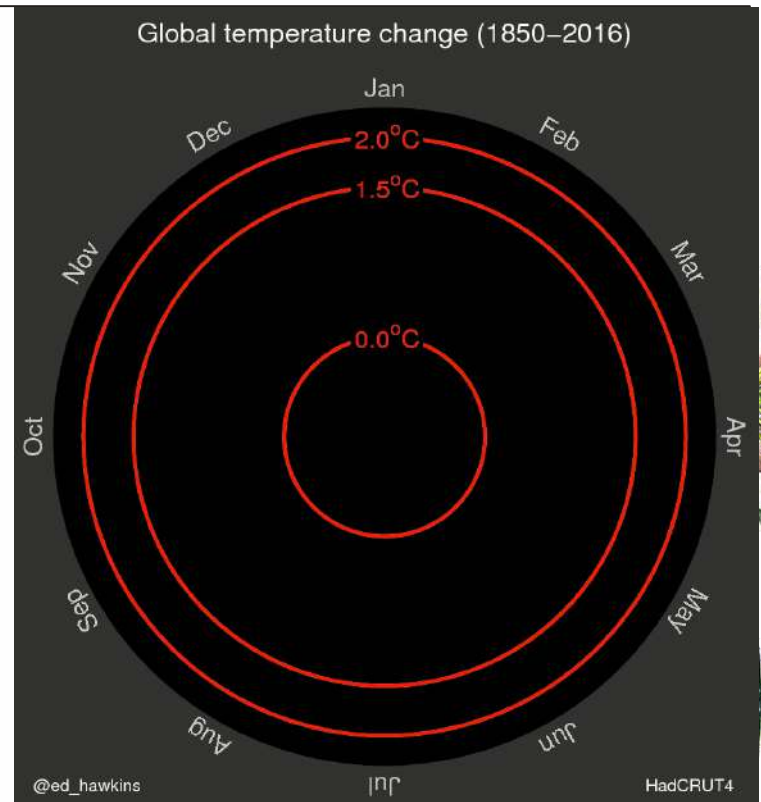
Plant a tree.

Trees absorb carbon dioxide from the air.

Turn off lights and electronics when you're not using them.



Spiralling global temperatures from 1850–2016



Source: Ed Hawkins, Climate scientist in the National Centre for Atmospheric Science (NCAS) at the University of Reading. IPCC AR5 Contributing Author.

Where is Malaysia?



- Agricultural productivity
- Rice and cereal crop production
- Need to embrace a new food system approach

Malaysia Average Precipitation



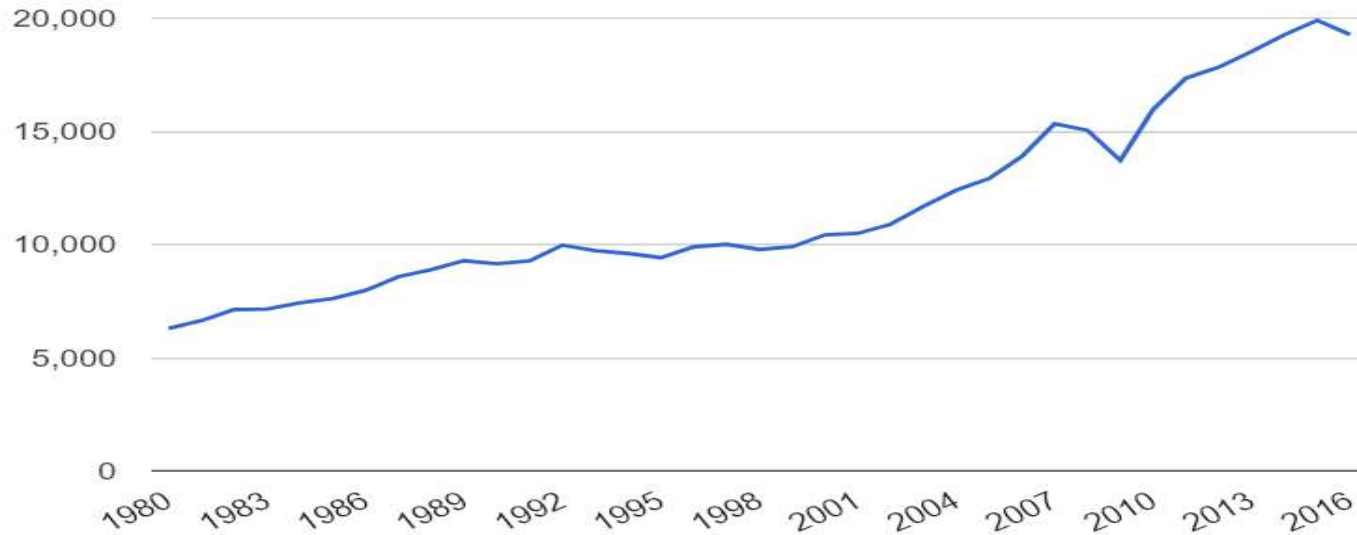
Source: TRADINGECONOMICS.COM | WORLD BANK

Malaysia Average Temperature



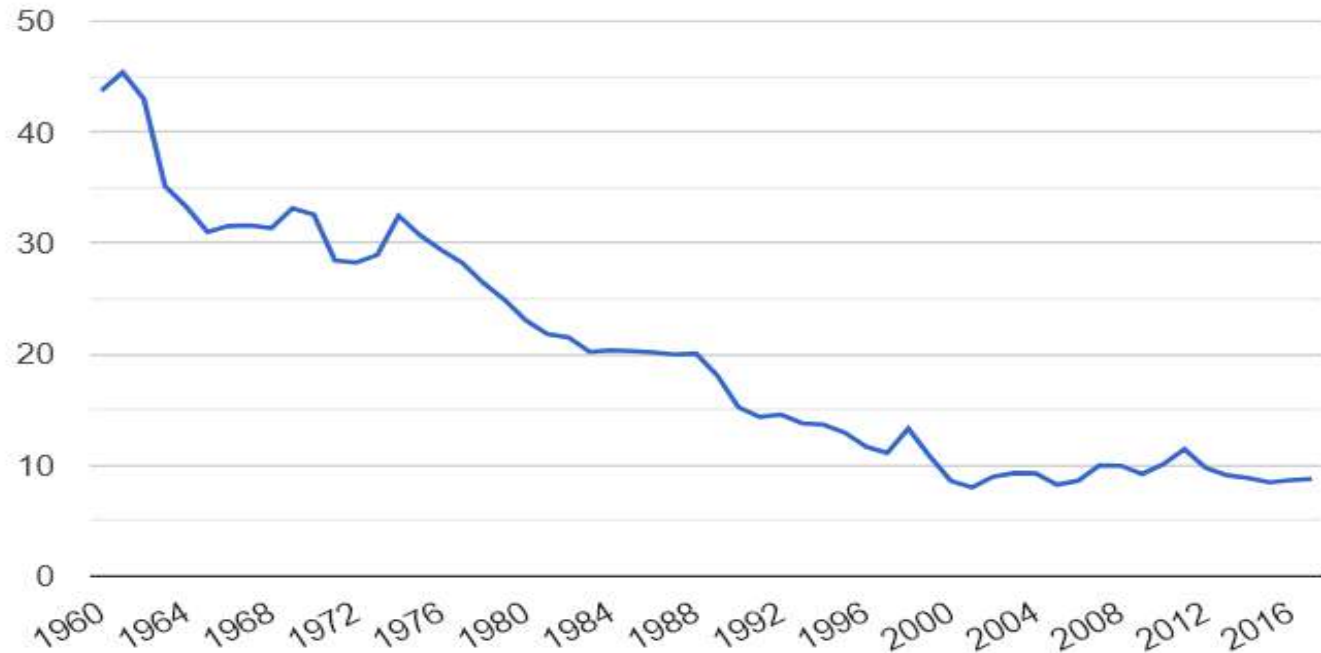
Source: TRADINGECONOMICS.COM | WORLD BANK

Malaysia Agricultural Productivity

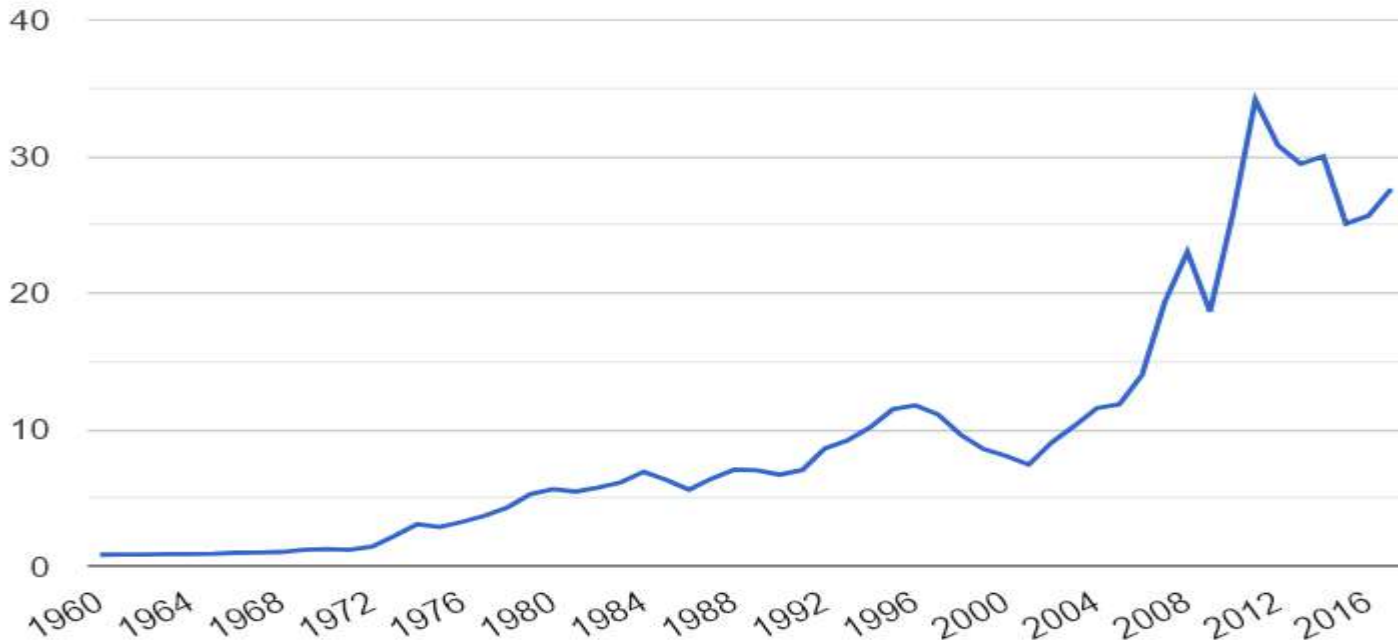


Source: THEGLOBALECONOMY.COM

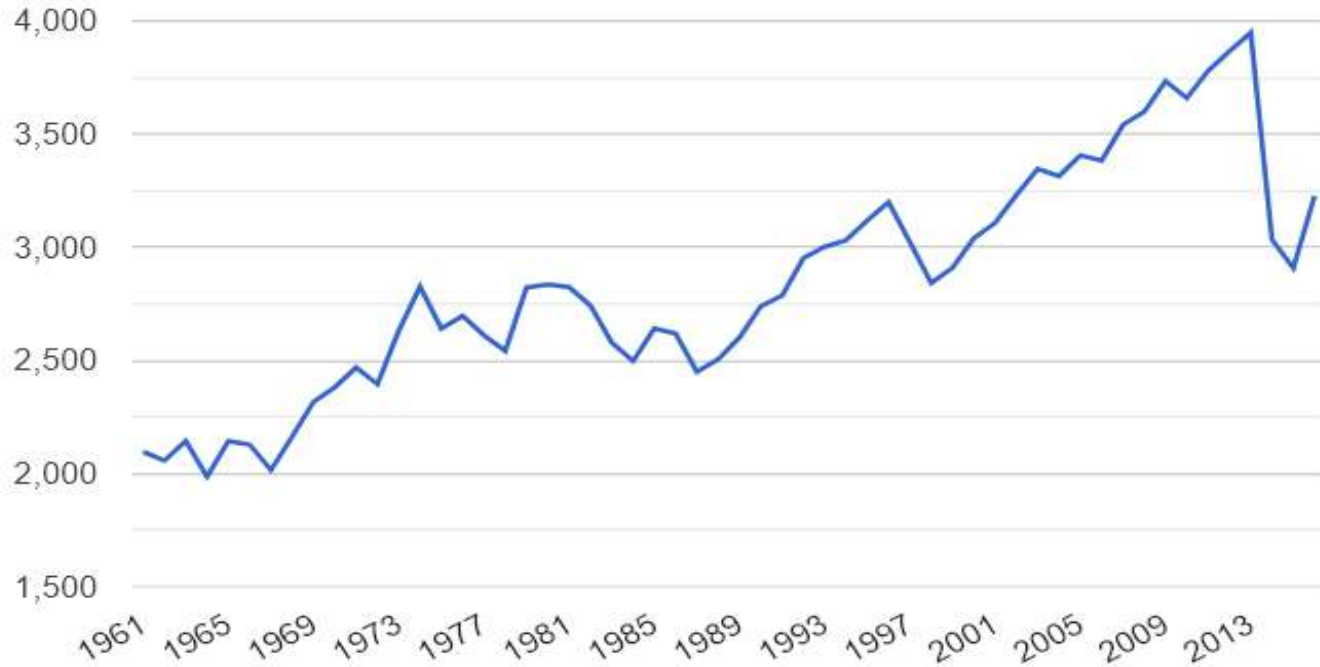
Malaysia-GDP share of agriculture



Malaysia Agriculture-Value Added

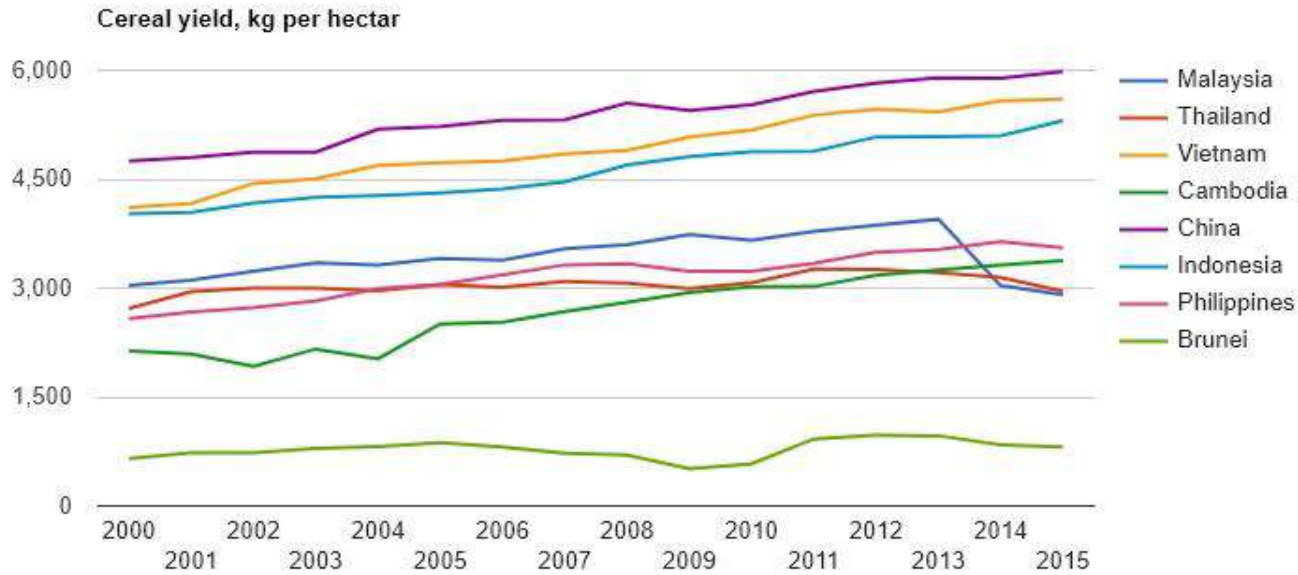


Malaysia Cereal Crop Yield by Hectare



Source: THEGLOBALECONOMY.COM

Cereal Yield for Malaysia and It's Neighbours



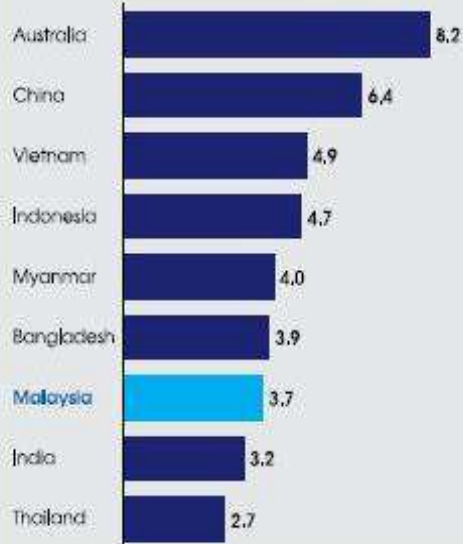
Source: TheGlobalEconomy.com, World Bank

Agricultural Productivity for Malaysia and It's Neighbours

Malaysia's agricultural productivity lags that of other countries

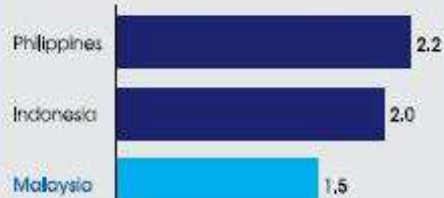
Paddy - average yield per hectare by country

Metric tonne per hectare per season



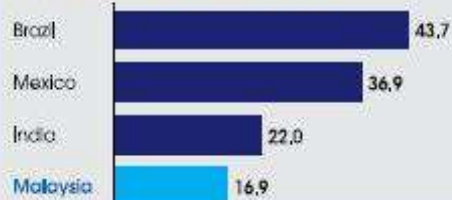
Dry seaweed - average yield per hectare by country

Metric tonne per hectare per year

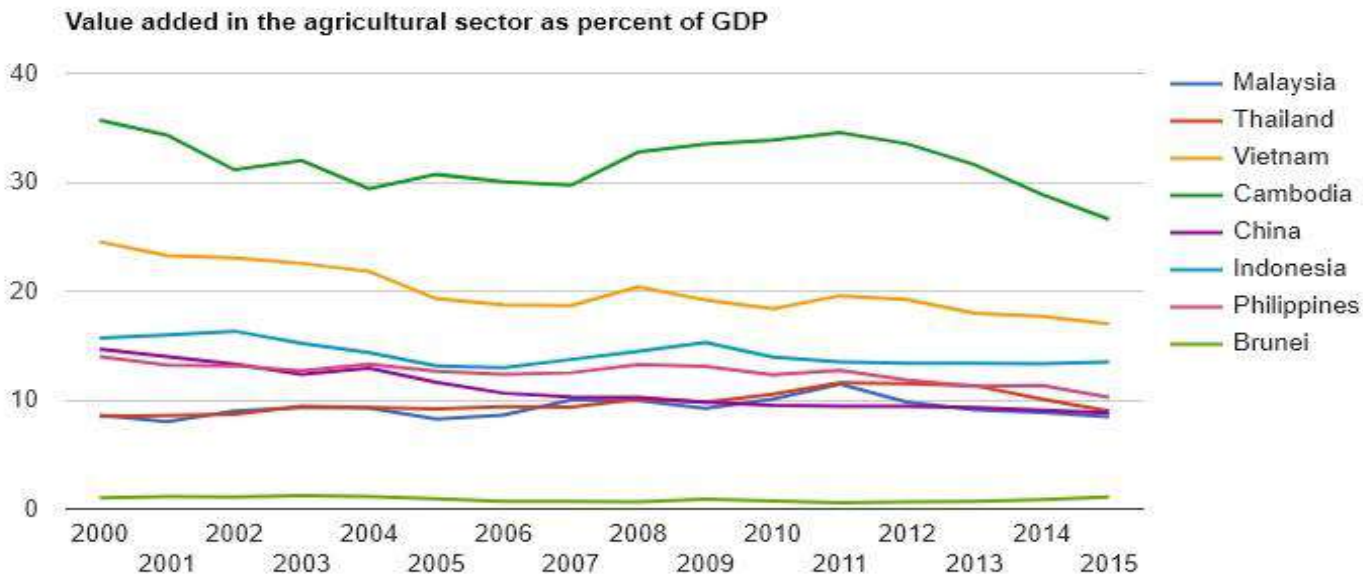


Papaya - average yield per hectare by country

Metric tonne per hectare per year



Agricultural Value Added for Malaysia and It's Neighbours



Source: TheGlobalEconomy.com, World Bank

Which way to GO?

Low agricultural productivity means food insecurity and probable hunger



Adjust to climatic changes and improve food systems and explore underutilised crops



Reduced Greenhouse emissions from agriculture and improved food productivity

Literature Reviews

Author(Year)	Objective	Method	Findings
Alam et al. (2011)	Impacts of Agriculture Productivity in Malaysia.	Primary and secondary data analysis	Natural disaster, drought, flood, plant disease have a negative impact on agriculture productivity and profitability
Ayinde (2011)..	Effect of Climate Change on Agricultural Productivity in Nigeria	Descriptive statistics and Co -integration analysis	Temperature change has negative effect while rainfall change has positive effect on agricultural productivity

The Results of Bound Tests

	F-statistic	Optimal lag length			
k=5				Signif.	I(0) I(1)
Model 1 (Total)	9.815***	(3, 0, 2, 2, 1, 0)		10%	2.331 3.417
Model 2 (Paddy)	6.415***	(2, 3, 1, 3, 2, 1)		5%	2.804 4.013
Model 3 (Rubber)	12.085***	(1, 1, 2, 0, 0, 0)		1%	3.900 5.419
Model 4 (Palm Oil)	4.973**	(1, 0, 1, 0, 0, 2)			

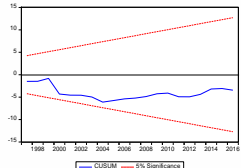
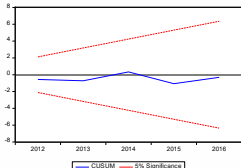
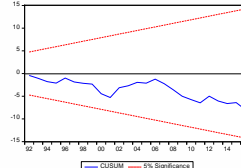
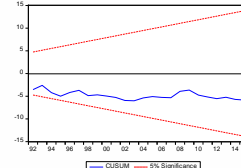
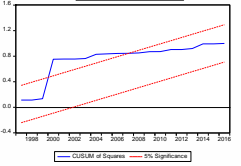
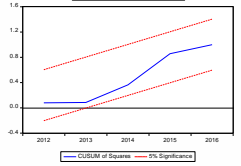
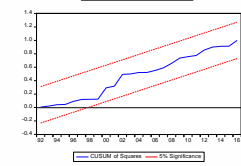
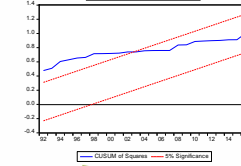
Note: *, ** and *** indicate significance at 10% level, 5% level and 1% level respectively.

Long-Run and Short Model Estimates

	Model 1 (Total)	Model 2 (Paddy)	Model 3 (Rubber)	Model 4 (Palm Oil)
Long-run				
L_t	-1.3157***	-1.4799***	-1.8875*	-2.1002***
K_t	0.9674***	0.5589***	-2.1459**	0.1104
$Land_t$	2.1916***	2.8018***	0.9886	2.6610***
$Rain_t$	0.4826*	0.8768***	0.3558	-0.0809
Tem_t	-1.4549	-5.3775*	-0.5309	-18.0073
a_0	-9.5029	-5.3763	12.4395	21.4792
Short-run				
$\Delta \frac{Y}{L_{t-1}}$	-0.4771***	-0.1998		
$\Delta \frac{Y}{L_{t-2}}$	-0.2353**			
ΔL_t		-1.2171***	-1.0394***	
ΔL_{t-1}		-0.0179		
ΔL_{t-2}		0.1657**		
ΔK_t	0.2303	0.0414	0.0247	-0.4344**
ΔK_{t-1}	-0.3533**		0.3956***	
$\Delta Land_t$	2.9481***	1.1223***		
$\Delta Land_{t-1}$	1.5107**	-1.5564***		
$\Delta Land_{t-2}$		-1.3158***		
$\Delta Rain_t$	0.1378*	0.1448**		
$\Delta Rain_{t-1}$		-0.1187*		
ΔTem_t		0.3372		-4.5979**
ΔTem_{t-1}				4.5803**
ECT_{t-1}	-0.6535***	-0.6298***	-0.1352***	-0.4124***

Note: *, ** and *** indicate significance at 10% level, 5% level and 1% level respectively.

The Results of the Diagnostic Tests

Diagnostic test	Model 1 (Total)	Model 2 (Paddy)	Model 3 (Rubber)	Model 4 (Palm Oil)
Normality	1.0682	2.5354	0.9888	6.4740**
Serial Correlation	3.8393	2.8865	1.1782	3.2906
Heteroskedasticity	15.6511	8.2405	14.5977	14.0991
Ramsey RESET	0.4564	0.1472	4.2925*	0.0959
CUSUM				
CUSUM ²				

Note: *, ** and *** indicate significance at 10% level, 5% level and 1% level respectively

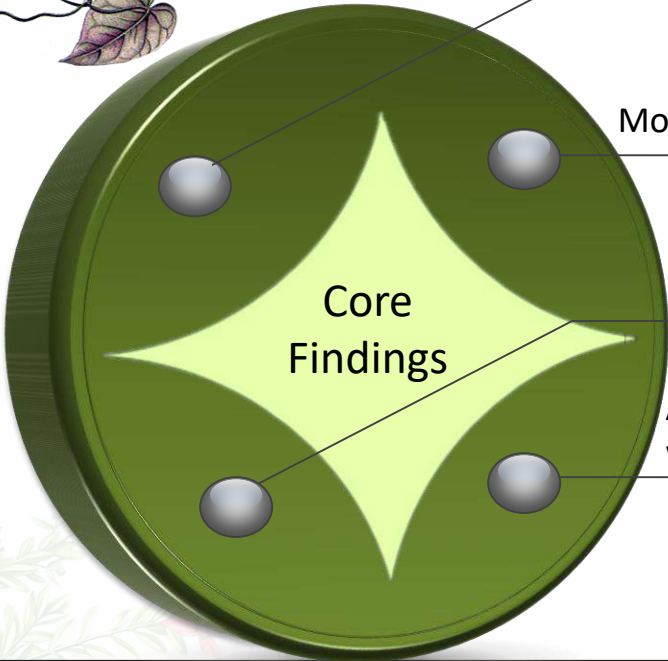


Effect of climate change on paddy in Malaysia is significant

More rainfall means better paddy plantation

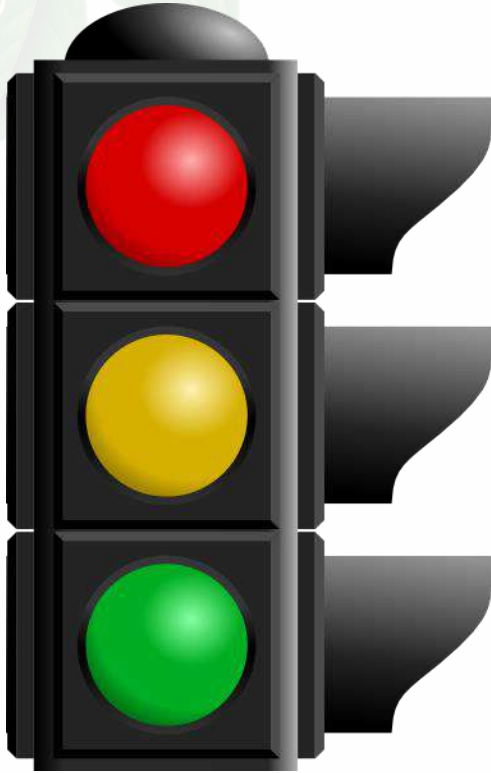
Higher temperature harms paddy plantation

Average temperature increase in the short-run will lead to a reduction in the palm oil productivity



Core Findings

In a nutshell



Reduce Greenhouse Gas Emissions

Maintain Malaysia temperature within range of 24°C and 28°C

Intensify research on improving food system adaptability to climate change





**Thanks for
listening!**

Any questions?

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